The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

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SWEET POTATO

INFLUENCE OF MINOR ELEMENTS ON MYSORE SOILS AND CROPS

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(The responsibility of facts or opinions rests with the several authors of the articles)

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SWEET POTATO

K. Gopal Iyengar, *Senior Assistant Botanist*

AND

Dr. L. S. Dorasami, *Economic Botanist*

Owing to the acute and constant shortage of Cereals in the country, this root crop is gaining prominence as a subsidiary food. Dorasami and Iyengar (*Mysore Agricultural Journal, Vol. XXIII, No.* 3) have reviewed the position of the crop in the State and have stated "two types of sweet potato—the red and the white—are under cultivation. Commercial crops are considerably mixed but work on isolation of superior clones is under way". Brief mention is made in this note of a few varieties isolated from among the stocks under cultivation in and around Bangalore.

The experimental and field work on this crop was taken up on the Central Farm, Hebbal, during 1943. Several collections of different types of vines were made and kept under observation. Of the large numbers of collections made, 10 types were finally retained as representing the local varieties under cultivation. Of these, 4 varieties produce white roots; and the remaining, red ones.

Among the varieties producing white roots, *Lalmahal* and *Hasaruvani* have heart-shaped, entire leaves. The young leaves of *Lalmahal* are copper red while those of *Hasaruvani* are larger and green with a fringe of red colour along the margin (Fig. 1). The roots of the former are buff yellow in colour and sweet to the taste. *Hasaruvani* produces cream-coloured roots with many eyes and the taste is insipid (Fig. 2). *Rani* and *Pathal* possess leaves which are deeply lobed, the leaves of *Rani* are not only larger but also very often have 1 to 2 lobes extra. The roots of *Rani* are ivory white, medium sized, fusiform and very sweet to the taste. The root shape and size of this variety is very desirable and the produce also is very uniform in quality. The roots of *Pathal* are creamy, small cylindrical and not so sweet as those of *Rani*.

Out of six varieties producing red roots, *Vaibhava* and *Sojiga* have leaves whose lobing is shallow (Fig. 1). The young leaves of *Vaibhava* have a reddish tinge on the border, while the leaves of *Sojiga* are not only larger in size but also have one to two lobes extra. The roots of the former are pinkish, long and tapering, while the latter are pale salmon, chunky, with numerous close set eyes (Fig. 3). The remaining four varieties are characterised by a leaf,

whose depth of lobing is medium. In *Deenabandhu* the young leaves are bronzed along the border and the basal lobes are often shouldered. The roots are pink, large, and irregular, with prominent eyes. In field trials this variety has out-yielded the rest. The leaves of *Raja* and *Mahal* are very nearly similar, but the roots of *Raja* are light rose, large and fusiform, with few eyes. *Mahal* has salmon coloured roots, also of large size but more globular with numerous eyes (Fig. 3). The leaf margins are slightly wavy in *Gulab* and the roots are light rose, long, slender and sweetish.

In small-scale trials, the yield of these varieties has ranged from 6 to 12 thousand pounds per acre. *Deenabandhu, Sojiga* and *Raja* are very heavy yielders. Of particular benefit to market gardeners are *Deenabandhu* and *Sojiga,* since these two varieties produce sizable roots in three-and-half months.

Spacing trials, with rows 1½ and 2 feet apart and with 1 foot in the row, has demonstrated the superiority of the closer rows, the extra yield being about 1 ton or 12-13% more than in the wider rows. The crop planted in November usually gives a heavier yield than that in May, the difference in favour being 2 to 2·5 tons per acre or 24-30%. The maximum yield obtained so far has been 10·5 ton per acre, in a November planting employing the closer spacing.

These varieties bloom and set seed freely (open pollination), under conditions obtaining at Hebbal. A certain amount of variation exists in the above varieties as to the profusion of flowers and the quantity of setting. The variety *Lalmahal* is the most profuse flowerer and sets seed very freely.

This piece of work was carried out in co-operation with Sri. R. S. Aiyangar, Lecturer in Agriculture, Agricultural College, and Sri. M. L. N. Iyengar, Technical Assistant to the Director of Agriculture, to whom our thanks are due.

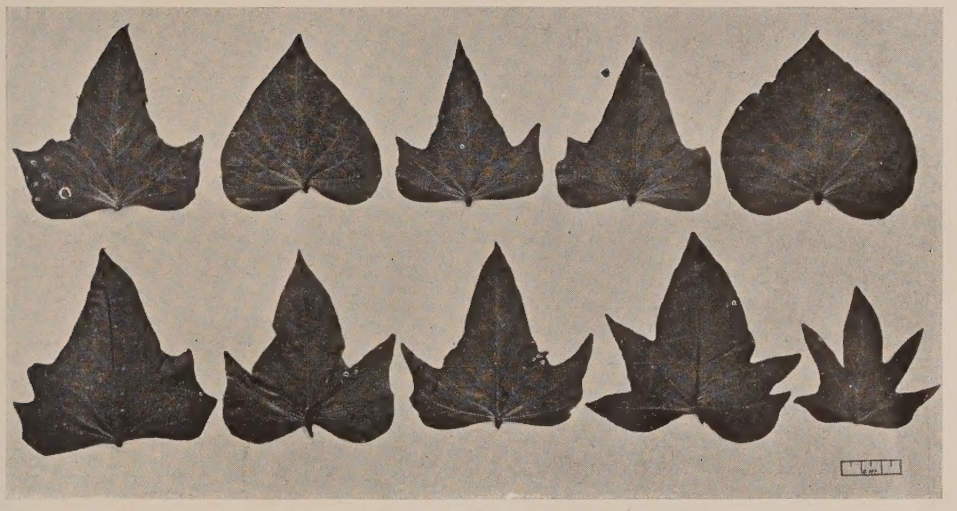

FIG. 1. Type leaves of varieties. L to R :—
Top row : *Deenabandhu. Lalmahal, Kaja, Vaibhava, Hasaruvani.*
Bottom row : *Sojiga, Mahal, Gulab, Rani, Pathal.*

FIG. 2. Type roots, white, L to R :—
Hasaruvani, Rani Pathal, Lalmahal.

FIG. 3. Type roots, red, L to R :—
Raja, Deenabandhu, Mahal, Sojiga, Vaibhava, Gulab.

A BRIEF NOTE ON ARECA INDUSTRY IN MYSORE

Dr. L. S. Dorasami, *Economic Botanist*

Areca is one of the important garden crops of the State. Being an article of daily use in almost every household in India, considerable care is bestowed on the management of the gardens and the preparation of the produce for the market. There is a large volume of internal and external trade.

Areca occupies an area of about 44,000 acres in the State being about 8% of the total area in India and Pakistan. Consequent to the partition, considerable area under this crop, *viz.*, 214,060 acres or more than 40% of the total area has been lost to India in East Bengal. When it is remembered that normally India imports large quantities of arecanuts from Malaya, Java, China, Ceylon and Burma to the extent of about 60 lacs of maunds or about 2/3 of the total production in India, the loss in area becomes significant and there is greater urge for the improvement of the agricultural and economic aspects of the areca industry.

Mysore is foremost in the arecanut growing areas in India. The cultivation is mainly confined to the Malnad areas abutting the Western Ghats in the districts of Shimoga and Chickmagalur under rainfall ranging from 60" to 150" annually; though it is cultivated in small patches in several Maidan Districts of Hassan, Tumkur and Mysore under tanks, where the rainfall ranges from 25" to 40" annually. Particularly in the former districts where it occupies more than 2/3 of the total area of the State, it is the principal cash crop for the agriculturists and the prosperity of thousands of families depend on the prices and marketing of the produce.

The cultivation in Mysore in common with closely similiar parts of Kanara and Konkan presents many special and interesting features and differs markedly from the cultivation practices of Maidan tracts. The gardens are situated at the head of valleys where a tank or small reservoir is maintained. The cultivation is generally in the hands of a special class of agriculturists known as "Haviks". The gardens are generally well cared for and subsidiary crops like pepper and cardamomum are frequent. Plantains are generally raised in the gardens as a nurse and shade crop to the areca till they get established and come to bearing. The annual cultivation is very elaborate and consists of digging around the base of the palms, weeding, application of farmyard manure and covering it with leafy twigs and addition of

fresh earth. This laborious process is carried out in stages and generally only a third of the garden receives full cultivation and other portions receive only leafy twigs and earth or nothing at all, so that full cultivation is given once in three years. In the course of ten or twelve years the elevated ridge between the rows disappears and the ground becomes almost level and the operation of interchanging the position of the ridges and the sub-drains are taken up. The drains are now filled up with earth and the level raised to about three feet and simultaneously the old ridge is dug and converted into a drain, so that what was formerly the drain becomes the ridge and *vice versa*. Though convention requires this transposition once in about ten years, in view of the enormous cost involved, it is carried out at much longer intervals extending even to twenty-five years. The forest in the high slopes adjoining the gardens are specially maintained for the purpose of supplying leaves and twigs known as "Soppina Betta" or the same is obtained in forests round about. Heavy quantities of leafy covering are applied which ensures against the leaching of the soil and exposing the roots of the palms during heavy rainfall adds fertility to the soil and keeps it moist during the summer months. The elaborate system of drainage ensures rapid removal of excessive water during monsoon.

Harvesting of arecanuts are carried out by trained coolies who climb the trees and test each bunch for the correct degree of ripeness before the bunches are cut and lowered gradually to the ground by ropes. The bunches are not allowed to drop to the ground if it can be helped. By climbing one tree, the bunches of as many nearby trees are harvested as possible and the coolie jumps from tree to tree and thus manages to harvest the trees for several hours without getting down. Harvesting is carried out a number of times during the season as often as the bunches are ripe. The number of harvests is generally four or in exceptional cases, five or even six.

Unlike other areas of arecanuts in India where the nuts are ready for marketing after drying and peeling of the outer covering, in Mysore and part of Malabar they undergo further processes of slicing and colouring. The curing is very elaborate and generally attended to by the garden owners themselves, though in Maidan it is customary to sell the nuts as they are harvested to people who cart away the nuts for curing. The curing consists of separation of nuts from the stalk, dehusking, slicing, boiling, draining and drying. The nuts are generally sliced into two by cutting across the kernel which gives *Batlu* (or dish) *adike*. In Maidan, sometimes, each half is further cut into 4 or 6 sections along the length. This gives *Chooru* (pieces) *adike*. A special kind of the latter is when they are cut into further

pieces also along the length which gives thin longish shreds called *Lavenga Chooru*. In so far (Malnad) nuts are also prepared entire without slicing they are called *Idi* (whole) *adike*. Overripe nuts do not lend themselves to slicing and they are boiled entire, except when they can be sold dried in the husk. The first boiling is done in plain water but more generally some quantity of *chogaru* or the extract of various barks and roots is added to the first charge. The *chogaru* is prepared by pounding the barks of *Eugenia jambolana, Pterocarpus santalimus, Adenanthera paronia, Ficus religiosa* and a few leaves of betel vine and boiling these in a large pit of water, a little slaked lime is added to the boiling material, sometimes some gingelly oil and a little jaggery also are added. The boiling is continued till a thick decoction is obtained when it is strained and used for boiling the arecanut. After each charge fresh water is added to keep up the proper consistency. There are several variations in the preparation of *chogaru* and almost every household has got its own recipe. This material is obtained by drying in the sun, the thick extract which remains in the boiling pot after the season's boiling work is over, is preserved for use during the following season. It is also the practice to use for the first charge water in which various barks and roots and other materials impart a deep brown colour to the nuts. The gingelly oil is supposed to impart some shine to the product. As soon as the germs get loosened from the kernels, the boiling is stopped and the boiled kernels are removed by means of perforated ladles to remove the excessive water and kept out for drying.

The drying is usually done in the sun for about a week on regular drying platforms constructed for this purpose spread on strong bamboo mats. They are removed in-doors during nights or when rain is anticipated. Sometimes when the season is cloudy or raining as happens particularly during early harvests, it becomes necessary to dry the kernels over smouldering fires. Special low framework is erected over four uprights about four feet above the ground level and mats are spread out to dry on these. Partial charring of the mats and the nuts are not uncommon and serious fires also occur occassionally. The quality is also darker, smells of smoke and fetches low prices.

As a great improvement over the crude and troublesome local method of drying nuts over smouldering fire which has often resulted in serious fires and extensive damage, the Department has been encouraging a drier of the type of "Choola" cast iron drier manufactured by Tynesdale Co., U.S.A., with furnace, suitable chimney, drying which has been found to be fairly satisfactory. A brick framework imitation of this drier has been adopted by the more progressive garden owners.

There are several variations in the method of boiling, etc., *viz.*, boiling in several charges of plain water and, in special cases, finishes with boiling in milk; boiling the whole nut and husk and drying subsequently, grinding the boiled kernels with various spices and beating the kernels and flattening them before boiling.

The boiling of arecanuts, besides other changes like imparting colour, etc., reduces the tannic acid content and removes the bitterness and makes it bland.

The yield varies considerably depending on the number of bearing palms, the performance of individuals, rainfall, etc. Yields of 50-60 maunds (of 25 lbs.) are generally expected in well-kept gardens and an average of 30 maunds may be reckoned as the yield of an average garden.

Several qualities are recognised in trade. *Hasa* fetches the highest price and is the boiled double-sliced nuts. *Bette* or *Gotu,* which is coarse and woody, fetches the lowest price. *Chickni* prepared out of slightly underripe nuts is the intermediate class. A similar division into *Hasa* and *Bette* is also made in the case of *Idi adike, i.e.,* nuts which are boiled without slicing. Depending on the uniformity of colour and size and locality of production, different classes of *Hasa, viz., Deshavar, Ramachandrapura* and *Annavar* are recognised. There is a very wide margin in the prices of different classes of *adike,* the best quality often fetching generally four or four-and-a-half times the price of the last class. The nuts of the Maidan country known as *Toresalu* come in a lower class. Sliced nuts always fetch a higher price than nuts cured whole.

There is considerable trade in arecanuts in Mysore. Large quantities are exported annually to Madras City, the districts of N. Arcot, Bellary and Kurnool. The arecanut produced in Mysore is generally of a superior quality and is about 25 to 30 per cent. higher than the prices of imported varieties. The imports to Mysore chiefly comes from Palghat and is roughly almost a third of the quantity exported. The annual exports generally amount to Rs. 40,00,000 (pre-war) during 1935-36, the quantity exported was 114,300 cwts. and the imports 41,500 cwts.

The Mysore Agricultural Department has been alive to the importance of Areca Industry in Mysore ever since the reorganisation of the Department in 1914. During that year a Government Farm was started at Marthur which is situated in the interior of the Malnad in Shimoga District. It was opened with the object primarily of experimenting on *Koleroga* of arecanut but was later developed to include experiments on cultivation of areca, among other things. Considerable work has been done, particularly in combating the *Kole-*

roga disease of arecanut which causes heavy loss of crop as a result of nutfalls and bud rot, the problem of judicious manuring of the crop, the cultivation of green manure crop in the gardens, introduction of improved areca drier and in the preliminary study of varieties. Unfortunately the farm was closed in 1939, as a result of which further work has been discontinued.

The work on *Koleroga* of the arecanut has related not only to the study of the life-history of the causative organism and devising of the main remedy, the spraying with Bordeaux Mixture and the importation of suitable spray pump, the Holder sprayer which this Department was the first to get out, but also to the different stickers, resin soda and casein and groundnut and other oils, their preparation, time of application, etc.

Spraying in large areas has been organised by employing local men temporarily to assist the regular staff and opening Depots. at convenient centres for the sale of sprayers and chemicals. The materials are advanced to the garden owners at the beginning of the season on 6 to 8 months credit without interest. From small beginnings, the spraying of areca has extended to about 12,000 acres annually and chemicals and spare parts worth Rs. 60,000 to Rs. 70,000 is sold through Depots and Co-operative Societies. A special circle was formed for this work under an Assistant Director of Agriculture with Headquarters at Tirthahalli, which was later on merged in the Shimoga Circle. It may be noted that there are in use more than 8,000 privately owned sprayers in areca gardens in Mysore.

The Mysore Agricultural Department has been the first to devise the remedy and adopt it with success against the disease which has meant the salvation of the Malnad garden owners. It has been taken up by the bordering Indian Malnad areca tracts which also thus share in the beneficial results of the work of the Mysore Department. Extensive manurial experiments on the suitability of different kinds of green manure, the use of artificial manures, the practice of growing and ploughing in green manure has been conducted for several years. It has been observed that an application of artificials similar to coffee raises the yield of nuts from 20 to over 30 maunds per acre and that once a garden is brought into a good bearing condition by judicious manuring for about 5 or 6 years, the yields do not fall off even if application of artificials is omitted for a couple of years afterwards. Moreover, it is seen that provided the usual practices of cultivation and mulching are kept up, an application of artificials in the prescribed dose once in three years is not only adequate, but maintains the trees in good cultivation.

The cultivation of green manure between the rows of areca palms in preference or as an adjunct to the usual practice of bringing in leaves from the forest, the damage to which as a consequence has often been protested against, has been found to be very useful.

A preliminary study of the varieties of areca nuts under cultivation and their performance has been made. Two separate varieties have been noticed in cultivation, *viz.*, Sweet areca which is provisionally named as Areca. (1) *Catechu* var *delicosa* and (2) the coarse *Rama adike*. The *sweet areca* is free from astringence and moderate in size and the fruits are somewhat round and the bunches are small. The *Rama adike* is distinguished by a much larger stem, the nuts are much larger, brilliant yellow in colour and bear fruits throughout the year. The latter is also more resistant to *Koleroga* and may be useful in breeding.

Notable differences are seen only in the size and shape of arecanuts which correspond to differences in shape and size of kernels which retain these characters in breeding.

Differences have been noticed in the inflorescence either compact or loose, in the taste of cured kernels as very astringent and almost bitter or sweet areca which are free from astringency, in the degree of hardness of nuts as hard or soft, in the colour of husk at maturity as yellow or green. Differences have also been noticed in maturity some palms which come to bearing early and others late. However, there is a very great need for the classification of the existing varieties and comparing them for their respective yielding capacities and the quantities of different grades of nuts prepared.

Acknowledge with appreciative thanks the help given in writing this article to the Senior Assistant Botanist-in-charge of Paddy work and the Plant Pathologist to the Government.

VARIETAL COMPOSITION OF SUGARCANE IN MYSORE STATE

B. Venkoba Rao, *Sugarcane Research Officer*

Introduction

Periodical crop surveys to determine the different varieties under cultivation, the area occupied by each variety and the extent of spread of improved varieties, has been an accepted practice in many advanced countries and is conducted in a highly systematic manner. The value derived from collection of such data need hardly be emphasised. In our country also, statistics relating to some important commercial and food crops are being compiled and published from time to time. As sugarcane forms one of the chief money crops, the census of cane varieties under cultivation is being recorded periodically and the last such record being during the year 1942. In accordance with the desire expressed by the Indian Central Sugarcane Committee that the latest position regarding the area occupied by the improved varieties be ascertained, the Government Sugarcane Expert requested all State Governments to furnish the information for the 1948-49 crop. Accordingly, information relating to Mysore was compiled with the kind co-operation of the District Agricultural Officers and the present paper deals with the cane varietal position in the State as stood during the year 1948-49.

2. Annual Acreage Cropped Under Sugarcane

In Mysore, as in most other places, Sugarcane is one of the chief cash crops and so much so the crop is raised wherever facilities exist. The total area under this crop on an average ranges between 45-50 thousand acres annually, the extent in each district being mainly restricted to the availability of water for successful raising of the crop. The varieties cultivated differ from place to place depending on climate and other factors. Taking into consideration the districts as units, the districts of Mandya, Kolar and Shimoga may be grouped as the most important sugarcane growing areas in the State. It is very likely in the near future the district of Shimoga may show a very rapid development of sugarcane acreage as a result of irrigation facilities that are being provided and also with the prospect of establishment of Sugar Factory in the district.

It is interesting to note that in spite of the increasing importance attached to the production of staple food crops in recent years both by the Government and the cultivators the acreage occupied

by sugarcane annually has remained practically steady during the decennium 1939-49. By a review of acreage figures under each district tabulated below it is however observed that there has been an appreciable decrease in area under this crop, particularly in the Districts of Kadur and Hassan, during recent years. As against this, there has been a corresponding increase in the districts of Mandya and Kolar. The acreage in other districts does not show much variation.

Statement showing Area under Sugarcane in Acres

District	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49
Kadur ..	1737	1862	2075	2169	2194	2109	2154	2160	1536	1999	1748
Chitaldrug ..	1440	1913	1584	1512	1256	1176	2275	1731	965	2645	1446
Hassan ..	5530	5945	5794	5651	5258	3318	4583	3545	3548	2916	2404
Shimoga ..	5957	6296	5848	6018	6333	6860	7148	6653	5591	5390	6363
Mysore ..	1167	1538	1779	1831	1811	1856	2508	4076	2575	2587	2598
Mandya ..	15614	17027	18034	13668	11511	10903	11745	12231	12239	17405	21020
Kolar ..	7100	7581	8305	7845	7392	6727	7469	7166	7040	9938	8385
Tumkur ..	2411	2557	2860	2791	2204	2284	2229	2205	2903	2227	2367
Bangalore ..	4034	4706	5008	4790	4502	4531	4314	4378	4294	4831	4193
	44990	49425	51287	46275	42461	44425	44145	39877	49938	48878	50434

3. Varietal Distribution and Behaviour

By a study of the data collected regarding the different varieties under cultivation in the State it was observed that, compared with the varietal composition that existed in the year 1942, there was not much appreciable change in varieties under cultivation except for the spread of a few improved varieties like CO 419, HM 661 and HM 647 to a larger extent, in certain districts. Considering the relative areas occupied by the local or indigenous varieties in each district, the sugarcane area in Mandya District is almost covered by improved varieties. This progress could mainly be attributed to the existence of the Sugar Factory in the area which encourages the growing of improved varieties only. In the districts of Bangalore, Kolar, Kadur, Mysore and Chitaldrug the local varieties still continue to the extent of 25 to 30 per cent. The area under improved varieties in the district of Tumkur, Hassan and Shimoga is markedly low compared with other districts, more than 60 per cent. being still under local varieties.

Taking the overall picture of the State, it is gratifying to note that the percentage area occupied by improved varieties is definitely on the increase approximating to 70 per cent. as against 50 per cent. estimated previously during the year 1942. All the varieties under cultivation have been classified as follows: (1) Local canes, (2) Exotic canes, (3) Improved Coimbatore canes, (4) Improved Mysore canes with a brief descriptive note of some of the important varieties, together with the percentage area occupied.

1. *Local canes.*—The three important local varieties of cane which are still occupying fairly large percentage of the cane area in the State are Pattapatti, Rasdali and Cheni.

(*a*) *Pattapatti.*—This is still a favourite cane of the small land-owner who grows cane for preparation of jaggery either for his own consumption, or sale in the neighbourhood. Although this variety is rapidly being replaced by improved varieties of cane, it has some points in its favour. It is a rich cane, non-flowering and matures early. It has a soft rind thus making crushing easy by bullock-driven mill. It gives gur of very good quality. It is also praised as a chewing cane and is cultivated for this purpose in the neighbourhood of cities and towns. The chief drawbacks of this variety are its softness of rind, lower yields as compared to other improved varieties, and highly susceptible to drought conditions. This variety at present occupies about 16 per cent. of the total cane area.

(*b*) *Rasdali.*—This is a thick type of cane cultivated for gur-making and also for purposes of chewing. It is harder than *pattapatti* but not so rich in sugar. This variety occupies nearly 5 per cent. of the total cane area.

(*c*) *Cheni.*—This variety is mostly cultivated in areas of restricted water supply. This is a thin cane with high vigour and tillering capacity. The juice is quite rich in sugar and well-suited for manufacturing gur. This variety is gradually being replaced by other improved thin and medium varieties. At present about 5 per cent. of the cane area is still occupied by this variety.

II. *Exotic Canes.*—Of the exotic varieties under cultivation Red Mauritius still continues to be popular under conditions of heavy rainfall, occupying nearly 2·5 per cent. of the area under cane in the State. White Java is another exotic variety which is grown in small areas in the districts of Kadur, Kolar and Hassan. There are the only exotic varieties which are under cultivation at present in the *raiyat's* holdings.

III. *Coimbatore Canes.*—Outstanding varieties evolved in Coimbatore Sugarcane Breeding Station and released for trial are obtained every year and tested under Mysore conditions. Selections made

from these are being issued from time to time to the sugarcane growers in the State. CO 419 and CO 290 are the only two Coimbatore varieties which are at present in general cultivation. Of the two, CO 419 is more popular than CO 290. The areas under CO 419 has largely increased in recent years, especially in the Sugar Factory area at Mandya. The main reason for this increase is due to the stoppage of first season planting (June to March) on account of irregular supply of water. So much so, the Sugar Factory which used to cover an area of about 6,000 acres by planting HM 320 variety, the most popular and best-suited variety for the season during this period, had to make up the deficit by proportionate increase in the area under cane during their second or B season plantings commencing from July by planting CO 419 which has outyielded other varieties. Consequent to this increase, the total percentage area occupied by CO 419 has gone as high as 44·6 in the State.

IV. *Mysore Canes.*—Of the canes evolved in Mysore and released to the growers, HM 320 still continues to be very popular and holds the field in the majority of the gur-producing areas of the State. Its richness, sparse flowering nature, high yields and fine quality of gur that could be produced, seem to be the chief characteristics of the variety which have tended to popularise it. In spite of the reduction of the acreage under this variety in Mandya, nearly 14 per cent. of the total cane area is occupied under this variety. HM 661, HM 647 and HM 645 are the three improved varieties released in recent years for general cultivation. HM 661 seems to be slowly gaining ground. This variety is a good yielder and its juice has high purity and sucrose content. Its relatively high fibre content make it unacceptable to some of the gur manufacturers who have no power mill. Consequently the rate of spread of the variety in spite of good agricultural character and chemical qualities of the juice, has been slow. HM 647 seems to be getting popular in Shimoga District. The variety possesses very many good qualities and is suited for the manufacture of excellent jaggery of high quality. The only chief drawback of this variety being its tendency to form pith after eleven months. Sugarcane growers who have taken to this variety have been sufficiently cautioned to undertake harvesting in time so that they may derive the maximum benefit. Variety HM 645 is thin to medium in girth, possessing good tillering habit and other agricultural qualities. Its juice yields excellent jaggery. Added to these, it ratoons well. This variety was developed specially to replace the local *cheni* and every effort is being made to popularise this variety in areas where irrigation facilities are not quite satisfactory.

Besides the above, early releases from Hebbal, such as HM 553, HM 544, HM 544 striped and HM 602 still continue to occupy small areas. With the exception of HM 544 which occupies about 1·6 per cent. of the total area under cane, the acreage occupied by other varieties are not quite appreciable.

A few new releases issued after critical tests on Government Experimental Farms, are under trial stages in raiyat's holding on subvention basis. Amongst these IC 8, IC 26, IC 29, IC 136 and IC 215 seem to be of promise and their further spread is being watched with keen interest.

INFLUENCE OF MINOR ELEMENTS ON MYSORE SOILS AND CROPS

1. Response of Ragi to Zinc Salts

Dr. S. V. Govinda Rajan, *Agricultural Chemist*

AND

H. G. Gopal Rao, *Assistant Chemist*

It is known that a large number of mineral elements are essential for normal plant growth. Some of these which are required in large amounts like nitrogen, phosphorus, potash and calcium are present in soils in fairly abundant quantities and are referred to as the "major" plant nutrients. Certain other elements, while being present in relatively much smaller quantities are equally essential to plant nutrition, and are termed "minor" or "trace" elements. Included in the latter category of plant nutrient elements are manganese, copper, boron and zinc and these elements are present in soils usually in very low concentrations. Availability to plants from soil of these elements in such small quantities frequently decide whether a crop will grow well or not. Absence or insufficiency of these elements in soils will limit the growth and yield of crops, even though the major elements like nitrogen and phosphorus may be adequately supplied in the form of fertilizers. These facts have been repeatedly proved by the restoration to fertility of lands in various parts of the world, like certain infertile virgin soils of Australia and the intensively cropped soils of America, through application of the minor elements found to be in deficient supply in those soils.

Deficiency of these minor elements in cultivated soils may occur in numerous ways. Lack or insufficient reserves of minerals containing these elements in the soil will primarily cause their deficiency, while erosion of the soil and leaching out of the soluble constituents by rain water over long periods of time are causes contributory to their loss from normal soils. Under conditions of normal cropping, these elements are removed by the plants from the soil and where crop residues and cattle manure are not returned to the soil in adequate quantities, repeated cropping under such conditions will cause a rapid decline in their content in the soils. The ultimate result of such decline is the lowered productivity of the soils and where the real reasons for the growing infertility are not properly understood and remedied, the lands gradually come to be abandoned as uneconomic holdings. This is a phenomena of common occurrence in our country.

The possibility of deficiency of some of these elements in Mysore soils and their being likely cause of reduced crop productivity in certain areas, has been under investigation in our laboratories during

Bulk Field Experiments on the Effect of Zinc Salts on Ragi

Serial No.	Locality and year	Treatment	Area of experimental plots (in guntas)	Actual yields		Calculated yields per acre			
				Grain srs.	Straw lb.	Grain in seers	Increase over control in seers (grain)	Straw	Increase over control in lb. (straw)
1	Hebbal Farm, 1949-50 (Rainfed)	$ZnSO_4$ at 5 lb. per acre	2⅓	37½	146	643	68	2503	275
		Control	2⅓	33½	130	575	..	2228	..
2	,, 1950-51	$ZnSO_4$ at 5 lb. per acre	10	190	407	760	273	1628	556
		10 lb. per acre	10	183½	343	733	246	1372	300
		Control	10	122	268	487	..	1072	..
3	,, 1950-51	$ZnSO_4$ at 8 lb. per acre	30	429½	1482	572½	- 9	1976	212
		Control	30	422½	1323	563½	..	1764	..
4	,, 1950-51	$ZnSO_4$ at 10 lb. per acre	22	360	1458	654½	74½	2651	486
		Control	22	319	1191	580	..	2165	..
5	Babbur Farm, Hiriyur, 1949-50 (Irrigated crop)	$ZnSO_4$ at 10 lb. per acre	2	29½	134	588	141½	2680	653
		$ZnCl_2$ at 10 lb. per acre	2	29	105	580	133½	2110	83
		Control	3	33½	152	446½	..	2027	..
6	R. K. Shala, Anekal, Tq. 1949-50 (Rainfed)	Zn acetate at 5 lb. per acre	5	13½	..	108	42	..	..
		Control	5	8½	..	66	..	..	..
7	S. K. V. D. Patashala Chikkanahalli, Sira Tq. 1949-50	$ZnSO_4$ at 5 lb. per acre	20	264½	1090	529	24	2180	202
		Control	20	252½	989	505	..	1978	..
8	Garudapalya School Farm, 1950-51 (Irrigated)	$ZnSO_4$ at 5 lb. per acre	11	187	680	1364	794	4992	2907
		Control	8	114	417	570	..	2085	..
9	,, (Rainfed) 1950-51 (Rainfed)	$ZnSO_4$ at 5 lb. per acre	7 acres & 10 guntas	1640	5916	226	34	816	314
		Control	14 acres	2690	9035	192	..	502	..
10	Sri. Subba Reddy's lands near Hebbal (Rainfed), 1950-51	$ZnSO_4$ at 5 lb. per acre	10 guntas	127	480	508	24	1920	320
		Control	10 ,,	121	400	484	..	1600	..
11	Sri. Munisamappa's lands near Seium Institute, Hebbal (Rainfed), 1950-51	$ZnSO_4$ at 5 lb. per acre	8 ,,	32	200	160	15	1000	200
		Control	8 ,,	29	160	145	..	800	..
12	V. C. Farm, Mandya (Irrigated), 1950-51	$ZnSO_4$ at 7½ lb. per acre	15 ,,	246	..	656	264	..	..
		Control	15 ,,	147	..	692	..	..	..
13	,,	$ZnSO_4$ at 7½ lb. per acre	22 ,,	233	..	424	79	..	..
		Control	22 ,,	190	..	345	..	..	..
14	,,	$ZnSO_4$ at 7½ lb. per acre	10 ,,	52½	..	210	6	..	..
		Control	10 ,,	51	..	204	..	..	..

Where the straw yields were not recorded, the column is left blank.

the past few years. It has been found that there is a positive crop response of Ragi to applications of small quantities of zinc salts in Hebbal soils and that salts of other minor elements like copper and boron either individually or in combination do not influence the yield.[1] Further field experiments to confirm this finding have been carried out during the past two years and this article records the results obtained from numerous field trials conducted in different parts of the State.

The application of zinc salts were at rates ranging from 5 to 10 lb. per acre and were in addition to the usual manurial doses, adopted for all the plots. In view of the small quantity of the zinc salts used, these were usually mixed with the oilcake given as general dressing and the mixture broadcast before sowing or transplanting as the case may be. The table summarises the various results obtained during the past two years.

It is seen from the table that applications of zinc salts at the rate of 5 to 10 lb. per acre have enhanced the yield of both ragi grain and straw, the increases ranging from a few seers to over 7 pallas per acre. The average increase in yields is of the order of 1 palla of grain and about 200 lb. of straw. On the basis of current prices, this would amount to an increased return of Rs. 30 to Rs. 35 per acre, for an additional expenditure of only Rs. 2 to Rs. 4 on the cost of the zinc salt used.

1. "Increased yields of ragi through zinc salt fertilisation." H. G. Gopal Rao and S. V. Govindarajan, *Curren Science*, Aug. 1950, **19**, 242.

INCREASING FOOD YIELDS IN MYSORE

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Crops may be raised on dry, wet or garden lands having the minimum quantum of moisture needed for the different kinds of crops. Such crops may be for food, fodder, fuel or industrial crops. For purposes of enhancing yields, it is desirable to promote greater rainfall and to get more dry lands under irrigated crops.

One of the commonest methods of balancing nature and assuring rainfall is by afforestation of waste lands, which incidentally prevents soil erosion and protects the six inches of surface soil which forms the basic agricultural capital wealth on which crops grow. Apart from this, other methods like contour bunding, the fixing up of groynes of bushy plants in streams and river banks, can also be resorted to.

There is at present great scarcity for food in Mysore and in other parts of India. While the population has leapt up from 80 lakhs to 90 lakhs in Mysore, the growing of crops adequate to feed the population has not kept pace. As a result, huge quantities of foods like jola, rice and wheat which could be grown if seriously tried, are being imported at terrible cost to the detriment of the larger and vital interests of the country. The extent of the subsidy paid in Mysore towards food, apart from the administrative cost of about thirty lakhs of rupees each year from 1943-44 is as hereunder:

1943-44	Rs.	71,591
1944-45	Rs.	28,17,751
1945-46	Rs.	30,12,440
1946-47	Rs.	1,75,76,124
1947-48	Rs.	75,23,052
1948-49	Rs.	1,50,61,703
1949-50	Rs.	1,26,00,000

To what extent this recurring expenditure is inevitable in the country's interest and to what extent it could be avoided has to be considered. The country has been singularly free from pestilence. For, except for the epidemic of influenza in the second decade of this century, and for the Bengal Famine in 1943-44 which are estimated to have inflicted a heavy toll of lakhs of persons, there has been no serious calamity in the country pestilentially affecting the general health of the people.

The assessed area of land under actual ownership in Mysore is said to be about 80 lakhs of acres, out of which half the extent seems

to be lying waste and uncultivated. Of the remaining area, an extent of about 2½ lakhs of acres is irrigated by channels, an equal extent under wells and other sources of irrigation, about 6½ lakhs of acres under tanks, and the balance is dry land. The average yield of paddy in Mysore is said to be 6½ pallas per acre and that of millets 2·1 pallas per acre, in spite of the fact that Mysore State has the largest number of tanks in the smallest imaginable area in the world. As compared with the yield of 3,000 lb. of rice per acre in Japan, or 2,500 lb. of rice in China, the yield in Mysore is less than 1,000 lb. per acre. As compared with 2,464 lb. of wheat per acre in Italy, the yield in India is only 728 lb. As against 313 lb. of cotton per acre in United States or 440 lb. in Egypt, the yield in India is only 97 lb. per acre. So, to avoid lands lying waste, to plant crops producing most food, to decrease the area under non-food crops, to raise crops on new lands, to bring more dry lands under irrigation, to grow more off-season crops and to economise time in the maturity of seasonal crops, to grow more vegetables, tubers, corn, etc., to serve as subsidiary and substitute foods, to fertilize crops heavily, to use more organic manures, to pay more attention to preparing manures, to change over to crops which mature in lesser time and draw lesser moisture, etc., are some of the methods by which more food could be produced. In addition, better cultivation methods, better seeds, better storage of crops, better protection of live stock from infectious diseases, the consuming of coarse flour and unpolished rice, systematic afforestation, the eradication of crop pests, the fixing of the minimum hours of work for agricultural labour in order to step up effective production and of providing adequate agricultural labour may prove useful in augmenting crop yields.

In respect of methods of cultivation, it is seen that very often lands are not ploughed, digged, forked, weeded or manured adequately. The raising of the maximum yield a land is capable of, under the best possible conditions, has to be insisted on. If lands are ploughed up soon after harvest, the alkaloids left over in the soil after cropping have greater chances of being disintegrated and reformed into plant foods than otherwise. Bacterial culture, so essential to plant life, would be increased by exposure to the action of wind and weather and fertility could be increased. More attention has to be bestowed in preparing the soil. As a rule Indian soils contain little organic matter. The greater use of leaf mould, humus and organic manures would tend to increase crop yields.

There is a tendency to cultivate commercial and industrial crops in preference to food crops. This has to be arrested and kept under control in order to avoid large food imports into country. If possible,

a reasonable proportion of the entire extent of one's holding may be earmarked as the maximum area in which commercial and industrial crops could be raised in preference to food crops except in the off-season—when any crop could be raised.

There is a great wastage of manure which has to be prevented. It is said that 69 million tons of cowdung is used as fuel in India although one-fourth of the total world cattle population is found in undivided India. A lot of leaf mould which could be ploughed into the land for increasing the fertility of the soil is left unused or burnt up. It would be a great criminal waste of national wealth if valuable nitrogenous manures are thus destroyed.

Economy in the use of water has to be rigidly enforced. Ordinarily water to a depth of one to two inches would be enough for raising paddy, but in wet lands, it is a familiar sight to see water impounded from four to six inches, as a result of which the soil leaches and the manures are washed out. Sometimes it is to overcome the trouble of the removal of weeds that a long, standing column of water is preferred, but the loss in yield due to leaching and washing away of salts is bound to be considerable.

The extent of deficit of food in Mysore for 1951-52 is expected to be 1,42,000 tons. At present about 35·6 per cent. of the total population in India is said to be dependent on some sort of rationing or other in spite of the fact that 73 millions of persons are working in agriculture in India over an area of 306 million acres. The food deficit could be arrested both by raising the output and increasing the cultivated extent.

So far as Mysore is concerned, the chief food deficit is in rice. By a slight change over in the methods of producing rice, it is possible to avert imports of rice. The area under channel irrigation assured of water supply is about 2½ lakhs of acres. At present only one crop of paddy is being raised on *nala* lands. If only two crops could be made to grow instead of one, the deficit could be turned over into surplus. In the *nala* areas, water is let into the channel on or about the 10th of June and cut out on or about the 10th January following. During all this long period of seven months only one crop of paddy is being raised all because of the fact that the ryots have to raise their own seedlings and green manures. But if only at the mouth of the channel, small nurseries for supplying seedlings are raised in advance, and paddy seedlings of 1½ to 2 months old supplied and planted before the end of June, the waste of time and waste of water for about two months on at least nine-tenths of each holding could be avoided. A paddy crop of about two months old, planted in June could easily be harvested in the middle of September following. Simi-

larly, if a second set of paddy seedlings and some green manure are supplied to the ryots immediately after the first harvest, a second crop of paddy could be easily raised. In this way two crops could be raised instead of one. And if, the whole process of sowing, manuring, dibbling and planting the seedlings is done in a systematic manner under Special Cultivation Officers under each channel, with adequate assistance of the staff of the Agri-Horticultural Departments, the yields could easily be quadrupled.

There is also an urgent need for enforcing a minimum of eight hours' work for agricultural labourers and training them in methods of efficient agriculture. The cry of raising the prices of agricultural products is incessant, but the question of enforcing hard work in agriculture as a necessary corollary has to be examined. As things are, the country is in the throes of a mounting inflationary spiral which cannot be controlled without hard work and greater food yields. Many a large landed ryot is helpless when agricultural labour fails him. Some legislation seems necessary to restore the equilibrium between production and supply. As the price of food enters into the cost of labour and of production of any kind of economic wealth, the need to increase its production and cheapen its cost claims top priority. A legislation for systematising agricultural, as of all other labour, seems therefore necessary in the larger interest of the country. Mechanisation of large areas and estates has to be tried simultaneously with educated skilled labour in India for greater production. Green manure has to be produced by each holder of land sufficient to satisfy his own holding. Compost manure is really a great means which can solve food production to a great extent.

Irrigation facilities, both tank, *nala* and underground, have to be improved by State management; clearing silt in tanks both major and minor using machinery for silt removal in the tanks in a systematic manner and completing all the big irrigation projects.

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